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Contents

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Where We Are, and Why

American Agriculture, 1962, is the most productive in the world. Our problems are of abundance, not of hunger or famine.

The efficiency of American farmers is apparent at our supermarkets, where shoppers can choose from thousands of safe, wholesome, and good-tasting foods—products of the farms of 50 States. Using only about one-fifth of their income, they select foods with a knowledge of nutrition and balanced diets that makes ours a nation of healthy, well-fed people.

American farmer efficiency is borne out at the dinner table, where, in effect, 27 of us share the bounty of a single farmworker. More prosaically put, the average U.S. farmworker produces the food needs of 27 people.

Modern living, American style, is another way to measure the efficiency of our farmers. Today, only 8 of every 100 American workers are farmworkers. The 92 others are providing the goods and services of modern living—manufacturing our cars and washing machines, running our banks, selling us insurance, building our homes, fixing our telephones, working in our hospitals and hotels, carrying our mail.

It all adds up to a standard of living never equaled before.

And, agricultural research has played a big part.

True, our Nation is blessed with rich natural resources. But their effective use is the product of research. Higher yielding plants, more productive animals, conserved soils and water, better machines, and better methods of disease and pest control—these have made our farmers efficient. These research achievements have made our high standard of living possible.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

NOW, A FORMULA FOR FUTURE HERBAGE YIELDS

Local precipitation records, plus past yields, may be used to predict grass production on semiarid ranges

■ Stockmen and range managers can become prophets with honor because of recent research by two ARS scientists.

Range conservationist F. A. Sneva and agronomist D. N. Hyder have worked out a formula which uses local precipitation records to estimate expected grass production at any location on semiarid Intermountain Ranges of the West.

With the formula a stockman can estimate (1) the yield per acre on a range for any single year, and (2) the long-term median yield (the point at which production years divide equally between high years and low years) from any range.

A reliable method of estimating range grass yields on the semiarid ranges has long been needed because production fluctuates sharply. The information will help in ranch production planning and will be especially useful in making adjustments in stocking rates.

Sneva and Hyder worked in cooperation with the Oregon Agricultural Experiment Station. They studied data from ranges in Oregon, Utah, and Idaho. The data from various locations were collected over periods of 6 to 13 years.

Their formula is a simple equation in which grass yield is expressed as a response to total precipitation during a crop year. September 1 to June 30 is considered to be the crop year on Intermountain grasslands. July and August rainfall is too slight to have a significant bearing on production. In the Intermountain area the bulk of precipitation normally occurs in the fall and winter.

To use the formula, a stockman first needs monthly precipitation records for his locality going back 6 or 8 years or more. These are available for most locations in the West. With them, the stockman can compute the median crop year precipitation for his locality. The median crop year is the point at which yearly totals divide equally between wet and dry years.

He will want to compare precipitation for the current crop year with median precipitation for his locality. This method can be used to plan grazing for the coming summer as early as

Turn page

April 1, and make adjustments up to July 1.

In applying the Sneva-Hyder formula, the stockman must add monthly precipitation totals received between the previous September 1 and the date of estimate. The total by April 1 is enough to make a preliminary estimate. By June 30, when the full crop year is known, a final estimate can be made and expressed as a percentage of deviation from the median crop year precipitation.

This percentage of deviation from the median is applicable to herbage production, according to Sneva and Hyder. In careful observations made at their study sites, they found that herbage production in each locality has a relationship to total precipitation for the crop year.

This relationship is almost directly proportional. For example, if rainfall is 10 percent below the median for the locality, herbage production will be slightly more than 10 percent below median herbage production for the same locality. Knowing this and knowing, too, past grazing rates, a stockman can plan how many animals to put on his range during the coming season.

Herbage production in actual pounds of grass per acre also can be estimated on the basis of this relationship, if yield records are available for any year that rainfall records are also available. Yield data for only 1 year are sufficient to establish the median herbage production for a range. Where the data are not available, the stockman will have to take yield samples during the current crop year if he wishes to estimate production in pounds.

The new formula is applicable to native grass in good, fair, or poor condition as well as to seeded stands of introduced species of grass, but frequent recalculation will be necessary if the condition of the range is changing.☆

Ninth in a
Centennial Series

HORTICULTURE

Yields have tripled—fruits and vegetables are tastier, more marketable—ornamentals are prettier, longer lived, more useful

■ The impact of science on horticulture in the last century can be likened to a heavy freight train making a 100-mile run over the Great Divide.

The first 75 miles the train labored slowly up the incline. Then, on making the grade, the freight gained momentum and for the last 25 miles has been traveling at an increasing rate of speed.

A hundred years ago, farmers in the United States harvested an average of about 80 bushels of potatoes from every acre planted. During the next 50 years, the per acre yield average crept up to 100 bushels, and 25 years after that (1937) it was up to 120 bushels per acre.

Suddenly, the curve straightened up, and the average yield is now up to 300 bushels per acre.

The pattern is similar for other crops: In 1930, the average U.S. yield for cauliflower was about 225 crates per acre. Today, it's about 400 crates. Snap bean yields have risen from about 1.2 tons per acre in 1930 to nearly 2.5 tons; processing tomatoes from 4.2 tons per acre to about 12.4; lima beans from 810 pounds per acre to 2,400. The story is similar for fruits.

What was responsible for those spectacular advances?

Many reasons may be cited. But no one is certain exactly what scientific findings had the broadest effect. Certainly, the development of new organic pesticides has been of major importance. Increasing use of fertilizers and new knowledge of how to apply them also have swelled production totals.

Systematic varietal breeding has played a major role in achieving today's abundance. Real progress in plant breeding dates from 1900 when Mendel's classic studies of inheritance were first understood.

The effect this had on potato research, for instance, is interesting to review. By 1910, plant scientists began to look carefully for desirable qualities in potatoes with the full knowledge that such qualities could be bred into new lines, and that the new lines could be kept vigorous gen-

MECHANIZED HARVESTING of horticultural crops, such as potatoes, has advanced with yields that have doubled or tripled in 100 years.

BREEDING of new varieties has improved quality of fruits and vegetables dramatically.

eration after generation. The result has been development of the many widely adapted varieties we know today. More than one-half of the presently grown potato varieties were unknown as recently as 1930.

The same thing has happened with tomatoes (no varieties at all had been developed in the United States through plant breeding before 1860), onions, cucurbits, deciduous and citrus fruits, beans, peas, and ornamentals.

Improvement of flowers and ornamentals has been spectacular, although yield is not a major aim of flower breeders. Esthetic qualities and disease resistance have been enhanced immeasurably by modern knowledge of inheritance transfer. Chemistry is playing a major role in modern ornamental research. Growth-regulating compounds have been found that shortens stems, retain bloom size, deepen foliage color, and promise many future transformations of our traditional ornamentals.

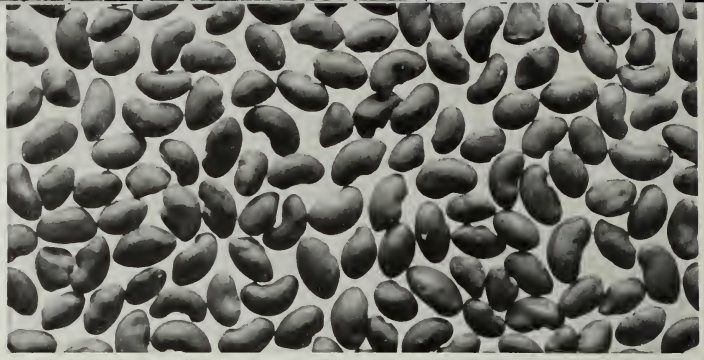
To illustrate even more specifically the growing impact of science on horticulture, consider the following developments—examples of but a few announcements made within the last 18 months.

- *Apple* blossoms can be thinned efficiently and economically with a chemical now recommended as an insecticide.
- Six varieties of *citrus* rootstock have been found to be resistant to burrowing nematodes.
- Badger Shipper, the first *cabbage* to show some resistance to clubroot, has been released.
- Five new muscadine *grapes*, adapted to the Southeast, have been developed. All are superior producers and self-fertile.
- Virus-free *raspberry* plants have been found that produce four times as much fruit as commercial planting stocks of the same variety.
- A new chemical treatment will enable florists and nurserymen to supply blooming *azaleas* any time of the year.
- A simple 4-minute chemical test, which detects exocortis virus infection in *citrus* trees, speeds certification of virus-free budwood.☆

SELECTION of resistant rootstocks is helping curb burrowing nematodes, just one of a long list of disease and insect pests that are being conquered by horticulturists.

Seed color is indication of viability in studies of—

GERMINATION INHIBITOR



■ A chemical inhibitor that occurs naturally in seed is the cause of low germination and poor seedling development in alfalfa and white, crimson, and Ladino clover.

This is a major discovery in the long effort to improve production of pasture and forage legumes. It was made by ARS plant physiologist S. H. West and agronomist H. C. Harris of the Florida Agricultural Experiment Station.

The chemical, which is associated with seed color, has been detected in seven alfalfa varieties and the clovers. The cooperators are now working to identify it, so that scientists can eliminate the substance.

Poor germination in some forage legumes has been a continuing problem for farmers, particularly in seed that has been stored through a second season. It occasionally occurs in first-year seed.

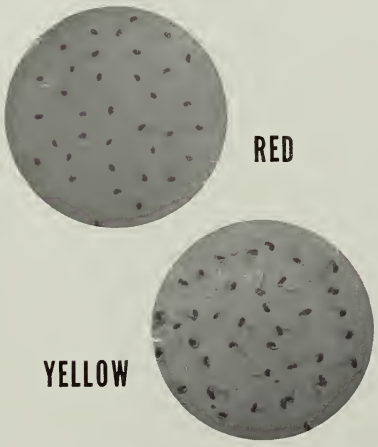
Completed research shows that, after 2 years of storage, dark-colored seed (red to dark brown) of both the alfalfa and the clovers has markedly lower germination than light-colored seed (olive-yellow).

Germination of the dark seed of Peruvian alfalfa, for example, was reduced from 54 to 3 percent by 2 years of storage, while germination of light seed of the same species was unaltered. Two-year storage of crimson clover reduced the germination of dark seed from 41 to zero percent and the rate for light seed from 55 to 6 percent.

Root and stem measurements made 4 days after germination showed that seedlings from dark afalfa seed were smaller than those from light seed.

The pattern of poor germination and seedling development in dark seed was consistent in all experiments with one important exception.

This involved a sample of light-colored alfalfa seed that had been soaked and dried alternately four times before an attempt was made to germinate it. The soak-dry cycles produced color changes in the seed as follows: one-third had turned red, one-third remained yellow, and one-third was between the dark and light color. In germination tests, the red and intermediate seed actually germinated a little better than the seed that remained yellow.



After 2 years storage, red to dark brown legume seed had markedly lower germination than olive-yellow seed.

The results in this soak-dry experiment indicate that the chemical inhibitor apparently needs time to migrate into the seed embryo to cause nonviability. This would explain the common experience farmers have of harvesting seed that becomes nonviable. Seed awaiting harvest is often soaked by rain or dew stimulating the early stages of germination. Drying stops the process, but this seed gradually turns dark in storage and loses viability.

The cooperators found ample evidence of the presence of the inhibitor. For example, water extracts from red and yellow alfalfa seed exhibited chemical differences. Red seed extracts contained more magnesium, calcium, potassium, nitrogen, amino acids, and nucleotides (protein particles involved in plant metabolism) than yellow seed extracts.

Using other techniques, the scientists detected a chemical fraction in dark-seed extracts not present in light-seed extracts. This fraction, they learned, contains at least three chemical components.

Finally, the cooperators tried without success to germinate light alfalfa seed by placing it on moist filter paper on which nonviable dark seed had been incubated for 3 days. This failure indicates the inhibitor had leached from the nonviable dark seed during incubation period.☆

Chemical analysis shows that yield is related to nitrate level in—

COTTON LEAFSTALK

■ Chemical analysis of cotton leafstalks (petioles) is an accurate way of determining when irrigated cotton needs additional nitrogen fertilizer, according to tests conducted by USDA scientists at Brawley, Calif.

In addition, the researchers found that the nitrate nitrogen levels in leafstalks are directly related to crop yields. High cotton production (90 percent or more of maximum) resulted when leafstalk nitrate levels were maintained at 2,000 parts per million or higher through early bloom stage of growth.

If leafstalk nitrate levels fell below 2,000 parts per million, yield decreased. And the extent of yield reduction was directly related to the length of time the nitrate levels were below this minimum.

ARS chemist A. J. MacKenzie and soil scientists W. F. Spencer, K. R. Stockinger, and B. A. Krantz say tissue analysis is an excellent experimental method for determining the nitrogen needs of irrigated cotton in the Southwest. The minimum leafstalk nitrate level may vary when soil and management conditions are different from those in their 7-year experiment.

Heavy nitrogen fertilization (240 pounds or more per acre) is required to carry cotton through early growth and blooming. But overfertilization late in the season promotes unwanted vegetative growth that makes defoliation difficult. An indicator of soil nitrogen level during the growing season would help growers adjust soil nitrogen to the varying plant needs.

In the experiments, rates and timing of nitrogen application were varied, and resulting soil nitrogen levels were measured by tissue analysis. Soils were supplied with adequate phosphorus and potassium for optimum production, and ample irrigation water was provided.

For the analysis, leafstalks of the youngest fully matured leaves on the main stems of cotton plants were sampled. Leafstalks were dried, ground, and subjected to laboratory chemical analysis for content of water-soluble nitrate.☆

CAN BOLL WEEVILS BE LED ASTRAY?

Arrestant makes cork appealing to pest

■ Boll weevils normally would starve rather than eat cork, wood, dried pinto beans, or even green beans. But at USDA's Boll Weevil Research Laboratory, State College, Miss., weevils have eaten all these items—and with voracious appetities.

Boll weevils prefer to feed only on cotton flower buds, called squares, and on bolls.

The unusual diet at the Mississippi laboratory was made possible by ARS entomologists who, for the first time, have extracted the substance that makes cotton squares appetizing to weevils.

For a number of years, researchers have been trying to isolate this substance. They have soaked cotton squares in petroleum ether, ethyl ether, ethyl alcohol, acetone, and other chemicals in an effort to extract the substance. Then, entomologists J. C. Keller and F. G. Maxwell decided to try extracting it by soaking squares in distilled water. It worked.

The entomologists call the substance an arrestant rather than an attractant, because weevils are not attracted or drawn to it from a distance but will feed on nearly anything containing the extract when they come in contact with it.

Field trials are necessary before the researchers can predict the value of the arrestant to cotton farmers.

One objective of the field trials is to learn whether weevils will lay eggs on plants, other than cotton, that have been treated with the extract. This is regarded as a possible control method, since weevils rarely have been known to survive when hatched outside a cotton square. Adult weevils lay their eggs in cotton squares and the hatching larvae feed on the inside of the squares.

ARS chemist P. Hedin is trying to analyze the arrestant chemically. If scientists can identify the arrestant, they may be able to synthesize it or to breed cotton varieties that do not contain it.

The boll weevil has caused an estimated $10 billion damage since it first entered the United States about 1890. Nearly $100 million are spent each year on boll weevil control, which adds 5 to 7 cents per pound to the cost of producing cotton.☆

Selective appetite is put to work as—

SNAILS WEED WATERWAYS

Marisa snails retarded growth of water-hyacinth by feeding on roots, shown above. Normal root growth is seen in plant below.

■ A large fresh-water snail that Miami, Fla., aquarium owners once marketed but got rid of because of its taste for expensive aquarium plants may prove valuable, based on its appetite.

Last year the snail, *Marisa cornuarietis* L., was tested as a control of several aquatic weeds that impede southeastern U.S. waterways. Results were encouraging.

The snail made a clean sweep of four weeds—coontail, southern naiad, Illinois pondweed, and salvinia. All are troublesome in canals, ponds, and lakes. And the snail inhibited growth and flowering of water-hyacinth and partially controlled alligatorweed—which are among the worst aquatic weeds in the United States. It partially controlled waterlettuce and fed readily on fanwort and filamentous algae.

Marisa, a native of South America, probably was established in Miami when disgruntled aquarium owners dumped live, plant-devouring snails in a canal. The snail is not found elsewhere in the United States.

At Fort Lauderdale, Fla., ARS plant physiologist D. E. Seaman obtained about a thousand snails and tested them for 3 months on the aquatic weeds and on rice in concrete tanks. ARS scientists at the Federal Experiment Station in Mayaguez, P.R., previously had carried on research on the snail.

In limited tests, 3- and 4-week-old rice plants suffered very little damage, even though the snails had no other source of food. But younger transplants and germinating rice seeds did not survive. In previous tests in Puerto Rico by agronomist E. Ortiz-Torres of the Federal station, the snail destroyed rice seedlings grown from direct field planting of seed—commonly used in the United States—but did little damage to older transplants.

Before introduction of the snail into any rice-growing area is considered, it will be thoroughly tested by scientists

Before snails were introduced, this pond in Puerto Rico had heavy growth of waterlilies.

Same pond is seen after snails controlled lily growth.

to determine any potential damage inflicted by the snail to rice and other crops.

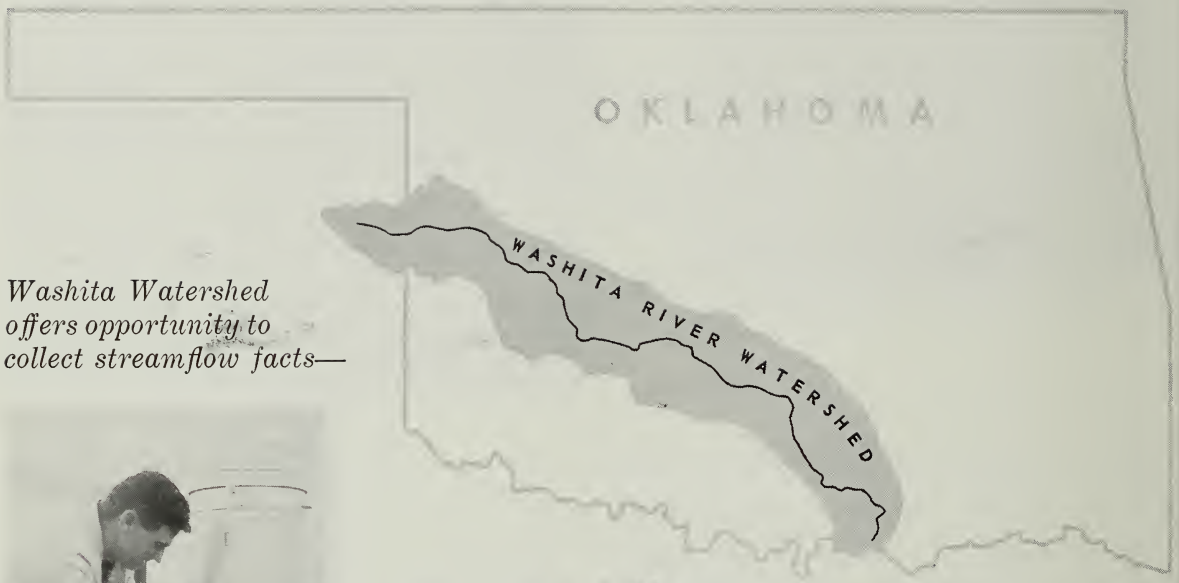
Two natural enemies—the boat-tailed grackle, a common south-Florida bird, and, apparently an alga—destroyed some snails during the tests. Other snail-eating birds and animals might also prey on *Marisa,* Seaman believes. In Puerto Rico, certain pond fish are thought to be detrimental to *Marisa* populations.

This snail, introduced in 1957 into several ponds in Puerto Rico, successfully controlled heavy growths of waterlilies for several years. It also nearly destroyed populations of another snail, host of the disease organism of schistosomiasis (snail fever or bilharziasis), a debilitating tropical disease.

Control of aquatic weeds by the *Marisa* snail might help control disease inexpensively in many parts of the world. Most earlier observations concerning the snail's weed-control potentialities have been made in connection with its disease-control effects. Weed control would permit fuller use of waterways for agriculture, transportation, hydroelectric power, fisheries, and recreation.

Because of this possibility, the U.S. Department of State helped to finance Seaman's study. The research at Fort Lauderdale on aquatic weeds is cooperative between ARS, the Central and Southern Florida Flood Control District, the Army Corps of Engineers, and the Plantation Field Laboratory of the Florida Agricultural Experiment Station.☆

Marisa snail at right is shown feeding on waterfern, snail at left just climbed glass side of aquarium.



Washita Watershed offers opportunity to collect streamflow facts—

BEFORE CONSERVATION BEGINS

Rainfall records will be kept by 170 recording gages.

Visualize the difficulty a man might have calculating how much water he can carry downhill in a leaky bucket if—

- He started with the bucket partly filled.
- More water was dumped in at several points en route.
- And water occasionally sloshed over the side.

This man needs an accurate measurement of the water he has at the end of his trip. In addition, he must know the total amount of water that was in the bucket at any time during the trip, where the water came from, and what happened to it.

USDA engineers face a comparable problem as they study the water resources of a segment of the Washita River Basin in central Oklahoma.

To gain a better understanding of flood flows, water movement, and sedimentation, they must account for the water in the river, additions from precipitation and groundwater recharge, and losses from evaporation, transpiration, and infiltration into the soil.

On the Washita, researchers have the rare opportunity to study the effects of flood detention structures and soil conservation measures. The engineers are now collecting streamflow and sediment load information from an unprotected drainage area—before conservation efforts begin. They estimate they will have until about 1970 to assemble the "before treatment" data. Later they will document changes in streamflow and sedimentation resulting from complete watershed protection.

From the studies will come information on the *downstream* effects of watershed protection measures in *upstream* tributaries. The studies should provide new concepts and improved criteria for conserving and developing soil and water resources for a total river basin.

The Washita is 1 of 11 rivers for which Congress authorized a basin-wide conservation effort. Work designed to retard runoff, stop soil erosion, and prevent flooding has been in progress since 1947 on the 5 mil-

lion acres drained by the Washita.

ARS engineers chose for their research a segment of the Washita Basin between Anadarko and Alex, Okla., including about 80 miles of the main river channel and contributing drainage area of 1,120 square miles. The watershed treatment program, which will include installations such as dams and floodways, has not been started by USDA's Soil Conservation Service on this reach of the river.

ARS hydraulic engineer M. A. Hartman heads the team of engineers and geologists who are assigned on the study.

To measure the "water balance" of the watershed—account for the water entering and leaving the study area—the researchers are assembling thousands of bits of data. They are measuring precipitation with a network of 170 recording gages spaced at 3-mile intervals over the study area. Fifteen gaging stations on the river and its tributaries record streamflow. Changes in groundwater levels are being observed in more than 60 wells on the river flood plain.

The researchers are taking inventory of land use and vegetative cover in the study area. And they will determine the amount of water used by crops and vegetation. Eventually they hope to relate water yields and flood flows to soil and vegetative conditions on the drainage area.

Scientists will make intensive studies of field-sized drainage areas. The information gained will help them interpret how changes in land use management affect runoff. Sedimentation and changes in the river channel will also be measured before and after the conservation work is applied to the area.

The ARS engineers are cooperating with other Federal agencies, State and local governments, and landowners in this long-term research effort.☆

ELBOW FLOW METER

Inexpensive, easily installed device measures flow of irrigation water at little pressure loss

An instrument designed to answer farmers' need for a low-cost, accurate way to meter irrigation water is being developed by USDA engineers.

A 90-degree elbow in a 3-inch, cast-iron pipe is a main component of the device called an elbow flow meter. Other parts are a U-tube manometer and tubing that connects the elbow to the manometer.

The device, which was designed at the U.S. Water Conservation Laboratory, Tempe, Ariz., measures the flow of water in the main pipe between the source and the field. No more than a third of western irrigation wells now have metering equipment. As water becomes scarcer and more expensive, irrigators are increasingly concerned about efficient water use.

ARS agricultural engineers L. E. Myers and K. J. Brust say that the elbow flow meter's operation is based on a hydraulic principle of liquid flow through a 90-degree pipe bend. This principle is that centrifugal force exerts greater pressure on the outer side of an elbow than on the inner side. And the difference in pressure is related to velocity of flow through the bend.

Measurement errors with the elbow flow meter have been less than 3 percent when flow is undisturbed in the pipe immediately above the elbow.

Results were as good with similar elbows made by five manufacturers.

The elbow flow meter has three advantages over present devices:

- It is less expensive.
- It is an adaption of a 90-degree elbow already in wide use.
- It causes less reduction in water pressure, or head, in the line.

To construct an elbow flow meter, Myers and Brust first drill openings centered on the outer and inner curves of a right-angle elbow. Then they connect these openings by ⅛-inch tubing to a manometer, which records the pressures on the outer and inner surfaces of the bend.

The engineers read the pressure measurements from the manometer, calculate the pressure difference, and use the difference in calculating the discharge rate from the pipe. If the discharge rate is known, any desired amount of water can be delivered by controlling the length of time water is applied.

Engineers have experimented with 3-inch elbows in standard cast-iron pipe. They have not used aluminum elbows. Research is continuing with cast-iron pipe elbows 6, 10, and 12 inches in diameter.

If the meter is made available to farmers, scientists say calibration charts probably would be prepared for each pipe size.☆

Multidirectional lift reduces labor costs in pruning Michigan orchards

SPACE BASKET

■ Pruning—an unpleasant, expensive, and time-consuming job in the production of tree fruits—becomes less of a chore with a new experimental pruning aid called a "space basket."

The device, which was developed in USDA-State research, consists of two pivoting arms with a basket at one end. A man with pruning equipment stands in the basket and manipulates several levers to move himself up (to a maximum height of 13 feet), down, left, or right to any position in the tree. The other end of the machine attaches to the hydraulic lift mechanism of a tractor's front-end loader.

Two men operate the pruning equipment. One man drives the tractor; after positioning it he gets off and prunes lower branches from the ground. The other man, in the space basket, prunes the upper branches.

One Michigan cherrygrower who used the experimental pruning equipment

Man in "basket" operates levers to go up, down, right, or left.

last year cut labor costs more than 40 percent. The two men using the new equipment averaged about 2½ minutes' pruning time per tree, at a cost of about 24 cents. Two men pruning by conventional methods (climbing the trees) averaged about 6 minutes per tree, at a cost of about 55 cents per tree.

In addition to pruning faster, the men using the space basket did a better job than the men who climbed the trees. More cuts were possible because the operator in the basket was able to reach more branches than the men climbing the trees, and both hands were free to operate the pruning equipment. Maneuverability of the space basket made it possible to prune three trees from one tractor position.

A Michigan applegrower who used the experimental equipment in 1960 cut pruning labor costs almost 60 percent. His labor cost in 1960 was $267, compared with $650 to $675 in previous years.

The space basket, which is not yet commercially available, was developed by agricultural engineers S. L. Hedden of ARS and C. M. Hansen of the Michigan Agricultural Experiment Station, East Lansing. More field trials and additional research are necessary before complete cost estimates of the space basket can be made. The engineers believe, however, it will cost considerably less than equipment now available.

Many commercial pruning units are expensive and not as stable in contoured orchards as is the tractor and space basket attachment. Some commercial models are also more difficult to maneuver in snow.

Limited field trials have been conducted on *picking* Jonathan apples with the space basket. Engineers say the results look promising. Research on both pruning and picking with the space basket is continuing.☆

WHY INFERTILITY IN HEALTHY COWS?

■ Why may a healthy cow be infertile for no apparent reason? It may be that her body produces antibodies against sperm or embryonic tissue.

Supporting this theory are USDA-State studies showing that cows can be made to manufacture the antibodies. These agents from the blood of such cows, mixed with sperm before insemination, cause infertility in other cows bred with the mixture.

Proof that cows can produce the antibodies comes from studies by ARS and Wisconsin Agricultural Experiment Station scientists. Bull semen was injected into a cow's bloodstream, then blood serum obtained from her. This serum was added to bull sperm used to inseminate six heifers. Five came in heat about 3 weeks later but were infertile; one conceived, but its embryo was deteriorating after 42 days of pregnancy.

For comparison, normal embryos developed in two heifers that were inseminated with bull semen mixed with blood serum from cows not injected with semen.

However, the cow that had produced the antibodies when bull semen was injected into her bloodstream became pregnant when she was mated to the same bull that had provided semen for the injection.

According to the scientists, this indicates the female's antibodies didn't reach her reproductive tract to cause infertility, or their concentration was too low to have an effect.

The scientists believe these antibodies aren't like others in the blood. They found that other antibodies don't affect fertility. These can.

The infertility antibodies can sometimes be detected in blood of cows that have had semen injections. (However, the researchers couldn't prove antibody presence by using standard agglutination technique or complement-fixation tests. A gelatin agglutination technique proved more sensitive and showed the antibodies present in some serum samples.)

It isn't known how antibodies affect sperm or embryo, if they can get from a cow's bloodstream to her reproductive tract, or if antibodies occur in uninjected cows, be they barren or fertile.

In studies at the Agricultural Research Center, Beltsville, and the University of Wisconsin, rabbits were used to determine how and when the sperm antibodies affected embryonic development. Rabbit embryos weren't affected as much in early growth as later. Day-old embryos survived treatment with the antibodies; most 9-day-old ones died.

Researchers believe the younger embryos lived because of a protective membrane surrounding rabbit embryos until the seventh day of pregnancy.

These experiments were conducted by ARS dairy husbandman A. C. Menge (now at Rutgers University) and University of Wisconsin geneticist W. H. Stone, dairy husbandman W. J. Tyler, and physiologist L. E. Casida at Madison, Wis.; and by dairy husbandman C. A. Kiddy at Beltsville.

Kiddy is now trying to determine if the capability to produce antibodies against sperm is heritable.☆

BETTER LIVING, A GOAL OF RAD

Rural home surveys pinpoint family needs, help focus the latest research findings

Research directed toward rural homes is helping to advance Rural Areas Development.

Good nutrition, efficient home management, and convenient and comfortable living are basic to all successful rural communities. They are especially important to areas undergoing problems of economic adjustment.

Here are ways ARS nutrition and consumer-use research is being applied.

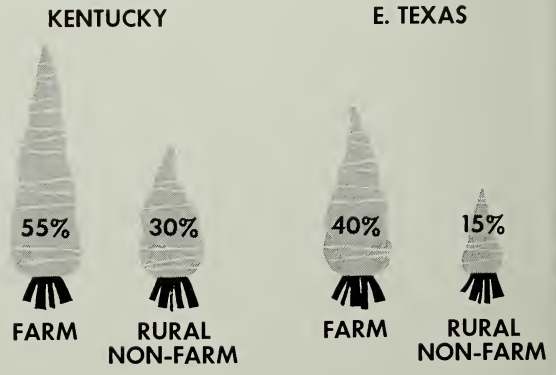
- ARS home economists have prepared research-based publications on home canning of fruits, vegetables, and meat and on home freezing of fruits, vegetables, poultry, and combination main dishes. Such information helps families of varying incomes make the most of the food they produce, and it helps them enjoy good nutrition during all seasons.
- Research on the nutritive value of foods and nutritional requirements provides the basis for several bulletins on food selection and preparation. For example, ARS home economists have issued a leaflet, "Food for Fitness—A Daily Food Guide," which is being widely used in nutrition education programs. They have developed food plans and market lists at different cost levels to help families budget food money wisely and decide what and how much to buy.
- As a result of other ARS studies, the homemaker has advice on how to buy, use, and take care of such major household equipment items as her washing machine and how to extend the life of clothing and household textiles by proper care and repair.

In addition, ARS scientists in home economics are giving specialized attention to the problems of Rural Areas Development. Their first step has been to gather facts about family living in RAD counties. They made surveys on housing, home production of food, family expenditures (for food, clothing, and other needs), and job-related expenditures of employed women. They interpreted findings for the benefit of home management and other Extension specialists.

Some of these ARS findings have been immediately useful to Extension workers on the scene; others have provided guides for research on the best ways to supply family needs.

Studies in RAD counties indicate considerable variation from place to place in the amount of food low-income rural families produce for home consumption. In a Kentucky area, farm families produced about 55 percent of their food supply and rural nonfarm families about 30 percent. In contrast, in an East Texas area, farm families produced 40 percent and nonfarm families 15 percent. ARS recommended to Extension specialists that they emphasize the importance of and encourage home production by families in low-income areas as a means of supplementing money income and assuring adequate nutrition.

These surveys also indicate relatively old populations as a result of outmigration of young adults. Since older people cannot be expected to make radical changes in their way of life, programs geared to their needs may well stress better and full utilization of their current resources while long-range programs look toward bringing in new industry and introducing more profitable cropping and livestock.☆



RAD survey found a large variance in amount of home-grown food consumed in rural areas—both within a given State and between States.

Screwworm eradication stepped up

Sterile screwworm flies—for use in a stepped-up eradication program in the Southwest—will be produced at a rate of 50 to 75 million per week at newly dedicated facilities near Mission, Tex.

The sterile-fly technique, developed by ARS, was used in 1958–59 to eradicate screwworms from the Southeast. Current eradication efforts were started last spring, after cold weather had greatly reduced the screwworm fly population.

Sterile flies are released from airplanes over the infested areas. Mating of sterile and native screwworm flies result in infertile eggs and eventual eradication of the pest.

The eradication program in the Southwest is a joint effort of ARS, Southwest Animal Health Research Foundation, Texas Animal Health Commission, and the States of Louisiana, Arkansas, Oklahoma, and New Mexico. State Extension Services and many other public and private groups are assisting in the effort.

Utah counties are brucellosis free

San Juan and Grand Counties in Utah have joined 117 counties in the United States as Certified Brucellosis-Free Areas, making Utah the first State in the West to qualify such areas.

ARS and the Utah State Department of Agriculture, as part of a 10-year brucellosis eradication effort, retested all the herds in the two counties and found no infection.

This breakthrough in the West is a major step in the Federal-State effort to stamp out brucellosis by 1975. C. K. Mingle, who directs the USDA's eradication drive, says annual losses to the livestock industry have been reduced from $100 million 10 year ago to $25 million today—and infection in the Nation's herds by 90 percent.

Other States, besides Utah, with one or more Certified Brucellosis-Free Counties are Maine, Minnesota, Wisconsin, Michigan, New York, Massachusetts, Connecticut, Pennsylvania, Maryland, New Hampshire, New Jersey, West Virginia, North Carolina, and the territory of Puerto Rico.

Enzyme action softens dates

An inexpensive method of softening date texture—by activating a natural enzyme of the fruit—has solved a major problem of the domestic date industry.

Normally about half the dates of the Deglet Noor variety, which make up more than 90 percent of the U.S. crop, fail to ripen to top quality. They lack a soft, smooth texture.

The softening process, developed by USDA and industry-sponsored scientists, activates natural date enzymes by increasing the moisture content of the fruit and exposing it to moderately high temperature. Enzymes are then deactivated by drying dates to normal moisture levels to prevent further change.

Enzymes convert a substantial amount of sucrose in the dates to invert (sirupy) sugar, accompanied by increased tenderness. The resulting dates have less tendency to dry out in storage and are especially suitable for the manufacture of date products, such as date pieces for inclusion with cereal flakes.

The process, adopted by the industry, was developed by ARS chemist V. P. Maier and industry fellow D.M. Metzler at the Fruit and Vegetable Chemistry Laboratory, Pasadena, Calif.

Improved hybrid onions developed

Two new hybrid onions with superior qualities for packaging in shipping containers have been developed cooperatively by ARS and the Agricultural Experiment Stations of Wisconsin and Iowa.

Nugget and Hickory are medium to small yellow globe varieties with very firm flesh, making them ideal for shipping after prepackaging. Both are especially adapted to production in Wisconsin muck lands.

Nugget, which has copper-colored scales, is a cross between the inbreds Iowa 736 and Wisconsin 101. It produces a high globe (a bulb that is slightly higher than it is in diameter) and is intended for use by Wisconsin growers as a major storage variety. It yields about the same as Epoch and Trapp's strain of Downing's Yellow Globe and about 15 percent more than Autumn Spice.

The parents of Hickory are Wisconsin 101 and Iowa 163. It pro-

duces a round bulb with a small neck, and its golden brown paper scales adhere well in storage. In tests at Madison and Montello, Wis., it yielded about 10–15 percent more than Autumn Spice and carried scales through storage better than Autumn Spice.

Seed should be available for the 1963 season. Onion seed producers have ample parental stocks and have started seed production.

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AGRISEARCH NOTES

New tomato fumigation aids Hawaii

Tomato growers in Hawaii now have prospects of expanded markets on the U.S. mainland because USDA scientists have modified a long-used fumigation method, involving methyl bromide gas.

Fumigation of Hawaiian-grown fruits and vegetables is necessary to prevent transporting any of three destructive fruit flies to the mainland.

The modified treatment was developed by determining more exact methyl bromide tolerance figures and by breeding of new tomato varieties. This involved slight modifications in the formula of methyl bromide gas and the time of fumigation. The modified process was developed by USDA's Entomology Fruit Fly Laboratory, Honolulu, in cooperation with the Hawaii Agricultural Experiment Station. It has been approved by the Plant Quarantine Division of ARS.

Methyl bromide treatment requires only 3½ hours, is cheaper, and needs less equipment than the heat treatment it replaces. The heat treatment, an 8- to 12-hour process, had a tendency to injury tomatoes. It required preconditioning, treatment with vapor heat, and postconditioning. It was used because tomatoes and certain other fruits would not undergo the old methyl bromide gas process.

Most Hawaiian commercial varieties are not injured by the modified method if fruits are in good conditions and at proper stage of ripeness—just beginning to show color.

Scientists at the station have experimental lines that produce tomatoes that can be treated without injury. From these lines, they hope to develop new commercial varieties for the mainland market.

Yearbook: a century of agriculture

Agricultural development during the past 100 years is portrayed in the 1962 Yearbook of Agriculture, *After A Hundred Years*. The volume contains 688 pages—and more than that number of photographs and drawings, depicting agricultural progress.

In the foreword, Secretary of Agriculture Orville L. Freeman sets the theme: "We cannot measure in tons or dollars, or even in terms of stomachs filled and bodies clothed, the accomplishments of these hundred years in agriculture, for the achievement is not alone in numbers or amounts but in challenges met and responsibilities laid upon us."

Specialists in every field of agriculture—more than 150—tell how these challenges have been met.

After a Hundred Years is available for $3 from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Crimson clover matures earlier

An early maturing annual crimson clover, intended for winter grazing, has been developed by plant breeders of ARS and the Mississippi Agricultural Experiment Station.

Seed of this new variety, named Frontier, is expected to be available to growers next year. It is best suited in the South and along the west coast.

In addition to early maturity, the new variety has large seed, which helps give it greater seedling vigor, faster fall and winter growth, and generally higher forage and seed yields than varieties now in use. Under field conditions, Frontier was 7 to 10 days earlier than other early varieties and 14 to 18 days earlier than late varieties.

More than half of the crimson clover seed produced in the United States is of reseeding varieties, which under favorable conditions produce successive volunteer stands. During recent years, however, volunteer stands that tend to weaken or fail entirely have been reported with increasing frequency. Frontier must be seeded each year.

Forage producers in the South and along the west coast have been having difficulty in maintaining stands of reseeding crimson clover in pastures used for winter grazing. The poor stands have been ascribed to spring overgrazing, seed weevils, and inadequate fertilization.

Frontier was developed from a crimson clover variety from Italy.

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